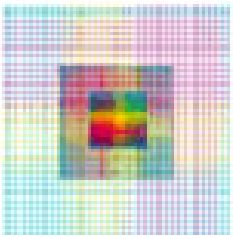


AUDIT II

Country Report

BULGARIA

George Kanavakis, Harris Andreosatos

Final Report 20.11.2002

SUMMARY OF ENERGY AUDITING

The energy policy of Bulgaria is designed by the Ministry of Energy and Energy Resources (MEER) and based on a long – term strategy coping with the natural conditions and present situation of the country, including the expected macro – economic development as well as the geopolitical situation and the possibilities for international co-operation in the field of energy. The main target of the Bulgarian government as far as the energy policy is concerned, is a secure and qualitative supply of fuels and energy in order to meet demand at a reasonable cost, while at the same time, recording the requirements for environmental protection as well as the social and regional needs of the country.

The Act of Energy and Energy Efficiency (July 1999) as well as the National Strategy for development of energy up to 2010, both approved by the National Assembly in July 2002, are the basic documents defining directions towards the development and utilization of energy efficiency in Bulgaria. The defined directions described by the Act of Energy and Energy Efficiency (June 1999) as well as the National Strategy for development of energy up to 2010 will be managed and implemented by the Energy Efficiency Agency (EEA). The Energy Efficiency Agency (EEA) has been recently transformed, from a private organisation into an Executive Agency (State Body) within the Ministry of Energy and Energy Resources, and it is also supervised by the Deputy Prime Minister and Minister of Economy. EEA after its transformation was instituted as the National State Body responsible for the development, coordination and implementation of the national policy for energy efficiency and renewable energy sources.

Energy Audit Programmes

There are no specific Energy Audit programmes. The process of energy audits in Bulgaria is random without taking into account specific models harmonized to European standards. The Technical Universities and some private companies, all within the framework of the Energy Strategy of Bulgaria that has recently been adopted by Parliament, have carried out separate energy auditing activities.

Other Programmes with Energy Audits

Programme MEEP – Municipal Energy Efficiency Programme

This project is financed by US Agency for International Development (USAID). The aim of MEEP is to support the development of energy efficiency projects. Each of the successfully developed municipal projects is an interesting example of flexible commercial financing schemes applicable to municipal energy efficiency projects. These projects include investments in all parts of the municipal infrastructure incorporating, street lighting, municipal building heating, water and gas supply, urban solid waste treatment and utilization of renewable energy sources. Each of these projects demonstrates ways to treat specific social or energy related problems in a municipality from the point of view of energy efficiency. Over 50 projects have been identified and developed.

Other activities related to Energy Auditing

There are some other activities, which include energy audits. Exemplary energy-auditing activities concern demonstration projects for energy efficiency in the domestic building sector and energy management in municipal heating services for schools.

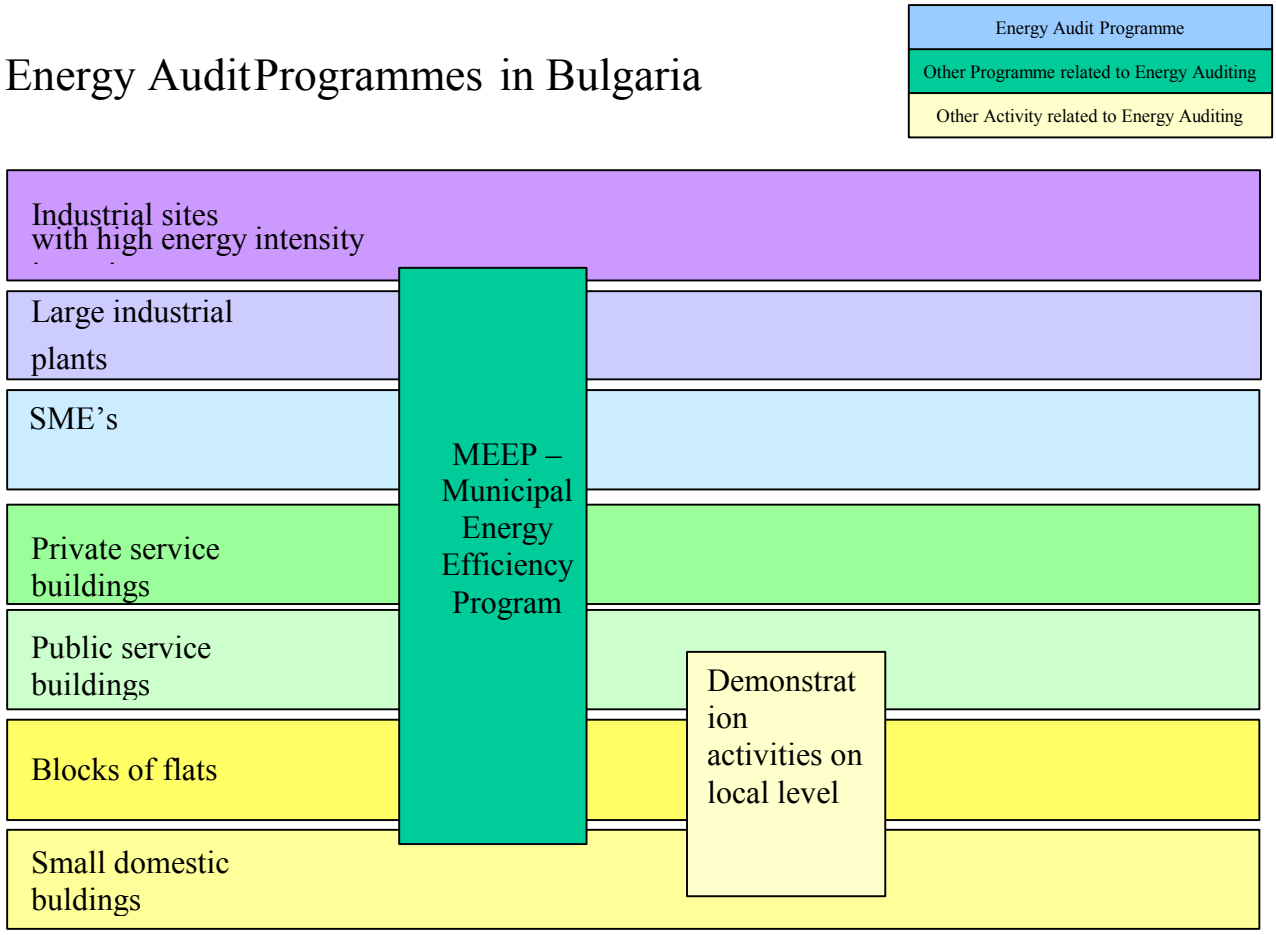


Figure 1. The Map of energy audits in Bulgaria

Table of EAP features coverage:

	Municipal Energy Efficiency Programme (MEEP)
Status	1999 – 2006
Administration	ELECTROTEK CONCEPT
EA models	++
Auditors' tools	-
Training, authorisation	+
Quality control	-
Monitoring	+
Volumes, results	+
Evaluation	+

+++ = Detailed information available
++ = Some information available
+ = Very little information available
- = No information available / does not exist

Contacts

General information	Kolio Kolev	37, Ekzarh Josif Str., 3" Floor, 1000 Sofia, Bulgaria	+359-2-9818561	KKolev@SEEA.government.bg
>>	Lubomir Tchervilov		+359-2-9631714	eneffect@ttm.bg

Country Report

Country Report written by	George Kanavakis	CRES
Country Report edited by	Harris Andreosatos	CRES
Based on the communication of	Kolio Kolev	State Energy Efficiency Agency

Disclaimer

The information contained in this report has been gathered from publicly available sources and personal communication with Kolio Kolev –Director in Energy Efficiency Agency (EEA) in Bulgaria that has been recently transformed into an Executive Agency within the Ministry of Energy and Energy Resources supervised by Deputy Prime Minister and the Minister of Economy. All efforts have been made to secure the veracity of the report, however the authors cannot guarantee the content.

THE COUNTRY REPORT

Table of Contents

1. Background and present National Policy

1.1 Previous activities

Bulgaria has followed an intensive energy policy the last few years. Emphasis had been given on the development of heavy industries by using energy that was mainly imported from the former Soviet Union at favourable price. This energy policy resulted in: firstly, a 2 - 5 times higher share of GDP (Gross Domestic product) in industry as opposed to most western countries, secondly, a higher share of energy intensive industries (organic and inorganic chemical industries, metallurgy) compared to the total industrial output, and thirdly higher energy intensity per GDP than the comparable western countries.

In addition, the emphasis on the development of heavy industries has caused substantial damage to the environment. In 1990s, Bulgaria experienced a significant decrease in the air pollution, mostly as a result of poor economic growth resulted in reduced industrial production. The period 1990-1998, both sulphur dioxide (SO_2) and nitrogen oxides (NO_x) emissions reduced by more than 35 %. In 1992 the National Environmental Protection Fund was established by the Council of Ministers in order to implement the Environmental Protection Act.

In Bulgaria there are some governmental and private organizations dealing with energy auditing activities. In 1993, scientists from the Technical University of Sofia and the Association of Energy Engineers (governmental organizations) attended training courses on energy auditing procedures in the framework of USAID (US Agency for International Development) program as well as they have also conducted numerous energy audits in DHSs, hospitals, public buildings, industrial enterprises, etc.

1.2 Present National Policy

The directions defined in the Act of Energy and Energy Efficiency (July 1999) as well as in the National Strategy for energy development up to 2010, are in line with the requirements set by the European Commission regarding Bulgaria's commitment to reducing its emission rates by 8%. More specifically, the Bulgaria's energy policy objectives include the following:

- Development of an up-to-date competitive energy market;
- Attraction of investments and privatisation in the energy area;
- Least-cost energy supply;
- Promotion and improvement of energy efficiency;
- Encouragement of the use of renewable energy sources;
- Integration of the Bulgarian energy system and energy market into the European ones.

Furthermore, recent power plants closure has reduced hazardous emissions in the environment but has also cut the flow of funds due to pollution fines. Nowadays, political reformation in the country is underway in order to address environmental issues, but progress is too slow holding off measures such as tax exceptions for companies, which use environmentally friendly technologies.

Specific environmental problems include: water (waste-water treatment do not properly operate), air (car exhaust gases) and soil pollution (especially from metal industries), nuclear waste from mines

and power plant, solid waste management as well as air and water pollution coming into Bulgaria from Romania neighbouring countries. Other environmental problems concern hazardous wastes (from factories) polluting the Black Sea Coastal regions, and industrial hazardous gases that damage the ozone layer.

The implementation of energy efficiency programmes, in agreement with the *Kyoto Protocol that the Bulgarian parliament approved in July 2002,* will allow Bulgaria to achieve its commitment to reduce the gas emission rates by 8 %, a GHG emissions reduction from about 82,990 (Gg) CO_2 to about 76,351 (Gg), based on the 1988 emission rates.

According to the directions defined in the Act of Energy and Energy Efficiency (July 1999) as well as in the National Strategy for energy development up to 2010, the key players associated with the introduction and development of Renewable Energy Sources and Rational Use of Energy are the following:

- Ministry of Energy and Energy Resources
- State Commission for Energy Regulation
- Energy Efficiency Agency
- Ministry of Environment and Water.

2. Energy Audit Programmes

There are presently no pure Energy Audit programmes implemented in Bulgaria.

3. Other Programmes including Energy Auditing

3.1 Programme MEEP – Municipal Energy Efficiency Programme

3.1.1 Programme goals

The aim of this programme is to support the development of energy efficiency projects.

3.1.2 Target sectors

This programme was available to all energy sectors in Municipalities including street lighting, heating and cooling systems, transportation and industry.

3.1.3 Administration

The above project has a 7-year duration (1999 – 2006) and it is financed by US Agency for International Development (USAID). ELECTROTEK CONCEPT, which is a well-experienced private company in developing over 45 energy efficiency projects all over Bulgaria, is the administrator and the operating agent of MEEP programme.

3.1.4 Implementing Instruments

There is no explicit information regarding the implementing instruments for this programme.

3.1.5 Energy Audit Models

Main components of the energy audit

- Collection of information associated with technological processes and costs on the basis of energy bills
- Analysis on the collected data for:
- How the energy is used or wasted
- Identification of the energy saving measures - ESM
- Where to focus on the efforts for energy efficiency measures
- Economic assessment of ESM
- Economic comparisons to arrange the priority of proposed ESM
- Action plan for the implementation of the selected ESM

Preparation for energy audit

- Collection of data for energy consumption, and monthly energy bills for at least 12 months as well as energy bills for the last 3 years;
- Collection of data for water consumption;
- Analysis of these costs (cost of energy expenses based on national currency);
- Data analysis based on geographical location of the site (data by meteorological service – degree days, external temperature, wind, sun light, etc.);

- Data analysis based on the status of the building structure (quality of wooden window frames, insulation materials e.g. roof, ceiling surfaces) and building envelope characteristics.
- Data based on the staff working hours (three shifts, double shifts, one shift for calculation of electricity, tariffs);
- List of equipment used in the plant (type, power, age) – boilers, heat exchangers, drying electric motors, lamps, etc

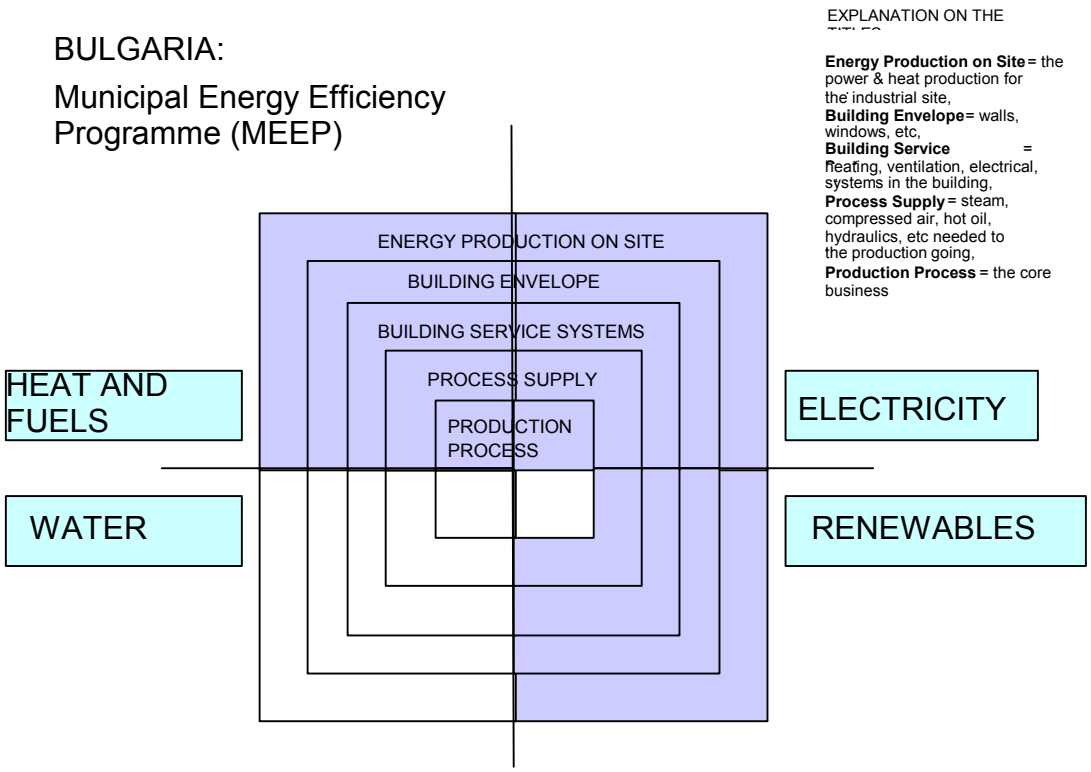
- **Conducting of energy audit**

- Site inspection and interviews with the energy manager of the plant;
- Work on site (measurements, data logging)
- Inspection and collection of detailed information concerning various industrial equipment of the site under inspection, including boilers (boiler-burner-chimney system), electrical and heating equipment (at peak tariff zone), lighting (number and type of lamps used, working hours);
- Analysis of the collected data;
- Consumption break-downs, Sankey-diagrams;
- Analysis of saving measures;
- Calculation of saving potential, estimation of the investments (including payback period related to the proposed energy equipment);

- **Detailed Reporting**

The report includes all the proposed energy saving measures that can be either implemented or at least the decision of implementation can be made. In addition, all calculations are presented with the corresponding criteria so that the applicability of the suggested saving measures can be checked. The detailed reporting consists of:

- A comprehensive description of the site (systems, operation, production);
- A breakdown of the total energy consumption (e.g. Sankey diagrams);
- An introduction of all profitable energy saving measures in detail, including some comments on implementation, saving calculations, cost estimates;
- All energy saving measures ranked according to e.g. simple payback time;
- The comparison of the energy consumption data with norm figures, benchmarking indexes, etc;
- Tables and graphs of measured values to improve the information value of the report



3.1.6 Auditors' tools

There are no official auditors tools.

3.1.7 Training, authorization and quality control

In accordance with the Energy and Energy Efficiency Law in the Republic of Bulgaria, the Energy Efficiency Agency, as an executive agency with economic functions, is authorized to effectively support the economic ministries, other administrations and the local authorities to elaborate and implement projects and programmes related to EE and RES, including the implementation of future training courses and the quality control of energy audits and expertise.

3.1.8 Monitoring

According to Art. 148 of the Energy and Energy Efficiency Law, the Energy Efficiency Agency and the Ministry of Energy and Energy Resources should collect and analyse data delivered by physical and legal persons, providing energy saving calculations and cost estimates related to the energy consumption of specific production activity including energy audits, finalized projects on EE and RES as well as other energy services.

3.1.9 Auditing volumes

There are no auditing volumes already recorded. Various licensed companies operating in energy services area currently execute energy audits across Bulgaria, but for the time being, the Energy Efficiency Agency does not have data related to the results from the execution of energy audits.

3.1.10 Results

- It has been found that the energy losses at the project of Pirinsko Pivo brewery were high, therefore limiting the long-term operation of the brewery. As a result, several energy saving measures have been implemented and resulted in reduced energy cost (about 6.4% on the price for a bottle of beer).

- The implementation of energy efficiency measures in the project regarding the street lighting of Pernik municipality resulted in reduced electricity consumption by 3.1 times compared to the initial situation while at the same time it increased significantly the illumination level across the town. Furthermore, the thermal consumption of the municipality buildings reduced by 32.8 %.

- The implementation of energy efficiency measures in the municipality of Pazardjik, reduced the electricity consumption of the street lighting across the city by 41%, based on preliminary calculations.

3.1.11 Evaluation

Each of the successfully developed municipal projects within the MEEP programme constitutes an interesting example of flexible commercial financing schemes. These projects consist of investments in all parts of the municipal infrastructure, including street lighting, heating in buildings, water and gas supply, urban solid waste treatment and utilization of renewable energy sources. Each project demonstrates specific ways to treat social or energy related problems in a municipality from the point of view of energy efficiency.

4. Other activities related to Energy Auditing

4.1 Demonstration Project for Energy Efficiency in Multi-dwelling Houses with Individual Heating

4.1.1 Goals – Short description

The above project was executed in the period 1995-1997 and concerned the implementation of a complex of 6 standard pre-fabricated panel type buildings in the town of Radomir. The energy efficiency measures that have been taken in order to improve the energy performance of the buildings are the following:

- Exterior wall insulation has been used in three buildings using extruded polystyrene board produced by the Greek company FIBRAN. The insulation material features good thermal insulation properties, low water absorption and high compressive strength. Insulation boards of 6 cm, 4 cm and 3 cm thickness have been applied for facade external walls, to balconies and staircases respectively. The insulation boards on external walls have been glued to the old plaster and nailed with plastic couplings, then a thin layer of plaster and a fiber-glass grid (for reinforcement of the plaster), external layer of plaster with special additives for elasticity and final finishing have been applied.
- Thermal insulation and water proofing of the roof.
- Thermal insulation of the ceiling.
- Restriction of air circulation in the joints between buildings.
- Carpentry replacement (wooden windows and doors) with aluminum ones in one of the demo buildings.
- Repair of existing wooden carpentry in two of the buildings.
- Replacement of the main entrances.
- Thermal insulation and glazing of balconies in one of the demo buildings (where carpentry replacements was executed).

4.1.2 Target sectors

The target of this programme is the building sector.

4.1.3 Administration

The Ministry of Energy and Energy Resources administrated this project, while its execution was carried out by the ENERGOPROJECT.

4.1.4 Results

The implementation of energy efficiency measures in the complex of 6 standard pre-fabricated panel type building, improved its the thermal characteristics as well as increased the human comfort conditions. However, it should be noted that the cost of the adopted energy efficiency measures was high.

4.1.5 Evaluation

It has been recorded that after the implementation of the energy efficiency measures in the complex of 6 standard pre-fabricated panel type buildings, more than 50% of energy savings have been achieved. More specifically, these energy savings were mainly achieved due to reduced electricity consumption, reduced energy losses and improved microclimatic conditions in the buildings.

4.2 Installation of a Centralised System for Monitoring and Control of Heat in 13 Schools and Kindergartens in the Town of Veliko Tarnovo

4.2.1 Goals – Short description

The above project was developed within the framework of the Balkan OPET and targeting mainly the Energy Management in Buildings.

4.2.2 Target sectors

Buildings

4.2.3 Results

- Thermal savings: 879,84 GCal/year
- Savings: 21,8%
- Heavy fuel oil savings: 120,95 t/year
- Price of heavy fuel oil: 101,15 Euro/ton
- Heavy fuel oil cost savings: 12234,00 Euro/year
- Investment: 31955 Euro
- Pay-back period: 2,61 Years